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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Feng Li

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EXAMINER

TRAN, KHANH C

ART UNIT

PAPER NUMBER

2631

DATE MAILED: 02/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/073,709	Applicant(s) LI, FENG	
	Examiner Khanh Tran	Art Unit 2631	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 November 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3,5,7,8 and 12-18 is/are rejected.
- 7) ☒ Claim(s) 4,6,9-11,19 and 20 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 November 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. The Amendment filed on 11/14/2005 has been entered. Claims 1-20 are pending in this Office action.

Response to Arguments

2. Applicant's arguments with respect to claims 1-2 and 7-8 have been considered but are moot in view of the new ground(s) of rejection.

3. The Amendment to the Specification filed on 11/14/2005 has been reviewed and entered.

4. The Drawings filed on 11/14/2005 has been reviewed and objected.

Drawings

5. The drawings (FIGURES 1 & 2) are objected to because ***the unlabeled rectangular boxes shown in the drawings should be provided with descriptive text labels***. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure

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number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

6. Claim 1 is objected to because of the following informalities: in line 9, "multipath" should be changed to -- multipath --. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1-3, 5, 7-8, 12-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brunner et al. U.S. Patent 6,301,470 B1.

Regarding claim 1, Brunner et al. invention is directed to a radio communications receiver, employing adaptive antenna array, for detecting first and second contemporaneously transmitted radio signals representative of first and second data.

Referring to figure 2, in column 4 line 65 via column 5 line 20, an array of antennas 4 is provided with each antenna 6 of the array 4 coupled to a corresponding input of a spatio-temporal filter 8. A direction of arrival estimator 10 is coupled to further inputs of a spatio-temporal filter 8. The multipliers 12 form a spatial filter 13. Thus, each version of the radio signals 1 detected by each of the antennas 6 is scaled with a corresponding coefficient by the directional arrival estimator 10. The scale versions of the radio signal are then fed into a wave front detector 11, which combines the received scaled radio signals to form a number of radio signal wave fronts y_M at the outputs of the wave front detector 11. Each of the radio signal wave fronts y_M is associated with radio signals 1 transmitted by one of the mobile stations MS1 and MS2 and arriving at the antenna array 4 at a particular angle of arrival.

In column 5, lines 30-40, the channel impulse responses are estimated by correlating the radio signals 1 corresponding to each wave front y_1 and y_2 with a training sequence embodied within the radio signals 1 and which is known at the receiver 30.

Brunner et al. does not expressly teach utilization of the beam forming techniques as set forth in the application claim.

Nevertheless, in column 1 lines 35-50, Brunner et al. discusses utilization of adaptive beam forming techniques to the exploiting spatial diversity, which is inherent in the communication of radio signals. Furthermore, in column 5 lines 30-40, because Brunner et al. teaches that in accordance with the determined strength of the wave fronts y_1 and y_2 , the spatio-temporal filter 8, is able to determine whether data may be recovered from a particular set of wave fronts associated with the same transmitted radio signals, for that reason, it would have been obvious for one of ordinary skill in the art at the time the invention was made that Brunner et al. teachings can be modified to implement the adaptive beam forming technique to further enhance the determination of whether data may be recovered from a particular set of wave fronts associated with the same transmitted radio signals.

In column 6 lines 10-50, referring to figure 2, the spatio-temporal filter 8 generates a channel impulse response corresponding to each of the mutually interfering radio signals 1 from the mobile stations MS1 and MS2 by comparing the detected combined radio signal wave fronts with a training sequence embodied in the transmitted radio signals 1 and which is known to the spatio-temporal filter 8. Furthermore, by comparing the detected training sequences from each of the radio signals 1 transmitted by the mobile stations MS1 and MS2, an estimate of a cross correlation factor x , between the radio signal wave fronts may be determined. Thus in order to cancel the interfering signals y_1 and y_2 from the radio signal detected from MS2, the signal re-constitutor 24 re-modulates and recodes the data S_1 , which is detected at the output of the data detector 14. Thus at the output of the signal re-constitutor 24 there is a

representation of the radio signals as transmitted by the mobile station MS1. The signal canceller 28 subtracts the interfering signals from mobile station MS1 from those signals from mobile station MS2 represented by the detected wave front y_3 . At the output of the signal canceller 28 radio signals substantially corresponding to those received only from mobile station MS2 are provided and fed to data detector 20, which operates to recover data S_2 transmitted by the second mobile station MS2.

Regarding claim 2, as recited in claim 1, the spatio-temporal filter 8 generates a channel impulse response corresponding to each of the mutually interfering radio signals 1 from the mobile stations MS1 and MS2 by comparing the detected combined radio signal wave fronts with a training sequence embodied in the transmitted radio signals 1 and which is known to the spatio-temporal filter 8. Furthermore, by comparing the detected training sequences from each of the radio signals 1 transmitted by the mobile stations MS1 and MS2, an estimate of a cross correlation factor x , between the radio signal wave fronts may be determined. The channel responses are stored in a matrix as common knowledge of one of ordinary skill in the art.

Regarding claim 3, in column 5 lines 50-67, FIG. 3 illustrates an example of channel impulse response estimates determined by the wave front detector 11. As will be appreciated from FIG. 3, the signal strength of the radio signals 1 generating the wave fronts y_1 and y_2 is considerably greater than the signal strength of the radio signals 1 generating the wave front y_3 transmitted by the second mobile station MS2.

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From the graph in figure 3, the position of the maximum signal strength can be easily determined. Therefore, in order to detect and recover the data signal strength S_2 communicated by the wave front y_3 , the stronger interfering radio signal wave fronts y_1 and y_2 generated by MS1, must be canceled from the radio signal wave front y_3 before data S_2 is detected by the data detector 20. In this way, the data S_2 represented by the radio signals 1 transmitted by mobile station MS2 may be recovered from the contemporaneously transmitted and thereby mutually interfering radio signals 1 detected by the antenna array 4.

Regarding claim 5, claim 5 is rejected on the same ground as for claim 3 because of similar scope. Furthermore, the receiver in figure 2 detects both signals S_1 and S_2 .

Regarding claim 7, the claimed limitations have been discussed in claim 1 rejection.

Regarding claim 8, referring to figure 2, block 22 is an interference canceller.

Regarding claim 12, the claimed limitations have been discussed in claim 1 rejection.

Regarding claim 13, referring to figure 2, the spatio-temporal filter 8 and direction of arrival estimator 10 generate the relative signal strength of the main path and multipath power distribution. The signal re-constitutor 24 corresponds to the claimed signal generator.

Regarding claim 14, the spatio-temporal filter 8 and direction of arrival estimator 10 generate the relative signal strength of the main path and multipath power distribution.

Regarding claim 15, claim 15 is rejected on the same ground as for claim 13 because of similar scope.

Regarding claim 16, the detectors 14 and 20 constitute the claimed decision module.

Regarding claim 17, claim 17 is rejected on the same ground as for claim 1 because of similar scope. Furthermore, the spatio-temporal filter 8 is for generating channel impulse responses. The interference canceller 22 comprises a signal re-constitutor 24, a cross correlation estimator 26 and a signal canceller 28.

Regarding claim 18, claim 18 is rejected on the same ground as for claim 17 in view of claims 13 and 16 because of similar scope.

Allowable Subject Matter

8. Claims 4, 6, 9-11 and 19-20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Gitlin et al. U.S. Patent 6,188,718 B1 "Methods And Apparatus For Reducing Cochannel Interference In A Mixed-Rate Communication System".

Vook et al. U.S. Patent 5,982,327 discloses "Adaptive Array Method, Device, Base Station And Subscriber Unit".

Antonio et al. U.S. Patent 5,621,752 discloses "Adaptive Sectorization In A Spread Spectrum Communication System".

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh Tran whose telephone number is 571-272-3007. The examiner can normally be reached on Monday - Friday from 08:00 AM - 05:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on 571-272-3021. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KCT

Pham Cong Tran 02/03/2006
Examiner KHANH TRAN